

What is claimed is:

1. A method of simulating a circuit having a hierarchical data structure, comprising:
 - representing the circuit as a hierarchically arranged set of branches, including a root branch and a plurality of other branches logically organized in a graph; the hierarchically arranged set of branches including a first branch that includes one or more leaf circuits and a second branch that includes one or more leaf circuits; wherein the first branch and second branch are interconnected in the graph through a third branch at a higher hierarchical level in the graph than the first and second branches;
 - selecting a group of leaf circuits from the first branch and the second branch for simulation, wherein each leaf circuit is represented by a matrix comprising a set of equations;
 - determining a strength of coupling between two or more leaf circuits of the group in accordance with a set of predetermined electrical coupling criteria;
 - if two or more leaf circuits are deemed be strongly coupled, combining the corresponding matrix of each strongly coupled leaf circuit into a combined matrix;
 - performing computation for the two or more strongly coupled leaf circuits in accordance with the combined matrix.
2. The method of claim 1, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be strongly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is less than a predefined threshold level.
3. The method of claim 1, wherein the step of combining is performed dynamically during simulation.
4. The method of claim 1, further comprising:
 - if the two or more leaf circuits represented by the combined matrix are deemed to be weakly coupled during simulation, separating the combined matrix into two or more individual matrices corresponding to each of the weakly coupled leaf circuits; and

performing computation for the two or more weakly coupled leaf circuit in accordance with the corresponding two or more individual matrices formed.

5. The method of claim 4, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be weakly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is more than a predefined threshold level.

6. The method of claim 4, wherein the step of separating is performed dynamically during simulation.

7. A system for simulating a circuit having a hierarchical data structure, comprising:
at least one processing unit for executing computer programs;

a user interface for performing at least one of the functions selected from the group consisting of entering a netlist representation of the circuit, viewing representations of the circuit on a display, and observing simulation results of the circuit;

a memory for storing a static database and a dynamic database of the circuit;

means for representing the circuit as a hierarchically arranged set of branches, including a root branch and a plurality of other branches logically organized in a graph; the hierarchically arranged set of branches including a first branch that includes one or more leaf circuits and a second branch that includes one or more leaf circuits; wherein the first branch and second branch are interconnected in the graph through a third branch at a higher hierarchical level in the graph than the first and second branches;

means for selecting a group of leaf circuits from the first branch and the second branch for simulation, wherein each leaf circuit is represented by a matrix comprising a set of equations;

means for determining a strength of coupling between two or more leaf circuits of the group in accordance with a set of predetermined electrical coupling criteria;

if two or more leaf circuits are deemed be strongly coupled, means for combining the corresponding matrix of each strongly coupled leaf circuit into a combined matrix;

means for performing computation for the two or more strongly coupled leaf circuits in accordance with the combined matrix.

8. The system of claim 7, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be strongly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is less than a predefined threshold level.

9. The system of claim 7, wherein the means for combining is performed dynamically during simulation.

10. The system of claim 7, further comprising:

if the two or more leaf circuits represented by the combined matrix are deemed to be weakly coupled during simulation, means for separating the combined matrix into two or more individual matrices corresponding to each of the weakly coupled leaf circuits; and

means for performing computation for the two or more weakly coupled leaf circuit in accordance with the corresponding two or more individual matrices formed.

11. The system of claim 10, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be weakly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is more than a predefined threshold level.

12. The system of claim 10, wherein the means for separating is performed dynamically during simulation.

13. A computer program product, comprising a medium storing programs for execution by one or more computer systems, the computer program product comprising:

a simulator module for simulating a circuit having a hierarchical data structure, wherein the simulator module is used in conjunction with at least a processing unit, a user

interface and a memory, and the simulator module includes one or more computer programs containing instructions for:

representing the circuit as a hierarchically arranged set of branches, including a root branch and a plurality of other branches logically organized in a graph; the hierarchically arranged set of branches including a first branch that includes one or more leaf circuits and a second branch that includes one or more leaf circuits; wherein the first branch and second branch are interconnected in the graph through a third branch at a higher hierarchical level in the graph than the first and second branches;

selecting a group of leaf circuits from the first branch and the second branch for simulation, wherein each leaf circuit is represented by a matrix comprising a set of equations;

determining a strength of coupling between two or more leaf circuits of the group in accordance with a set of predetermined electrical coupling criteria;

if two or more leaf circuits are deemed be strongly coupled, combining the corresponding matrix of each strongly coupled leaf circuit into a combined matrix;

performing computation for the two or more strongly coupled leaf circuits in accordance with the combined matrix.

14. The computer program product of claim 13, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be strongly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is less than a predefined threshold level.

15. The computer program product of claim 13, wherein the instructions for combining are performed dynamically during simulation.

16. The computer program product of claim 13, further comprising instructions for:
if the two or more leaf circuits represented by the combined matrix are deemed to be weakly coupled during simulation, separating the combined matrix into two or more individual matrices corresponding to each of the weakly coupled leaf circuits; and

performing computation for the two or more weakly coupled leaf circuit in accordance with the corresponding two or more individual matrices formed.

17. The computer program product of claim 16, wherein the strength of coupling between a first leaf circuit and a second leaf circuit is deemed to be weakly coupled if a combined resistive, capacitive and inductive coupling between the first leaf circuit and the second leaf circuit is more than a predefined threshold level.

18. The computer program product of claim 16, wherein the instructions for separating are performed dynamically during simulation.